

Questions 35, ~~36~~, 38, 41, 43, 44, ~~49~~, 51, 52, ~~53~~, 54, 85, 95a,c

35) a. 1650 kJ (shouldn't need calculator) b. 826 kJ (shouldn't need calculator)

$$\text{c. } \frac{1.00 \text{ g Fe} \quad | \quad 1 \text{ mol Fe} \quad | \quad -1652 \text{ kJ}}{55.85 \text{ g Fe} \quad | \quad 4 \text{ mol Fe}} = 7.36 \text{ kJ released}$$

d. 10.0g Fe = -73.6 kJ (10x the previous problem)

$$\frac{2.00 \text{ g O}_2 \quad | \quad 1 \text{ mol O}_2 \quad | \quad -1652 \text{ kJ}}{32.00 \text{ g O}_2 \quad | \quad 3 \text{ mol O}_2} = 34.4 \text{ kJ released}$$

$$38) \text{ a. } \frac{1.00\text{g CH}_4 \quad | \quad 1 \text{ mol CH}_4 \quad | \quad -891 \text{ kJ}}{16.034\text{g CH}_4 \quad | \quad 1 \text{ mol CH}_4} = 55.5 \text{ kJ released}$$

b. $P V = n R T$
 (0.974 atm) 1000L = n (0.08206) 298K

$$n = \frac{39.82 \text{ mol CH}_4 \quad | \quad -891 \text{ kJ}}{1 \text{ mol CH}_4} = 55.5 \text{ kJ released}$$

41) Water will require the most energy because it has the highest specific heat

$$q = m \Delta T c$$

$$q = 25.0 (22.0) 4.18 \qquad \qquad \qquad q = 2.30 \times 10^3 \text{ J}$$

Hg will have the largest temp. change because it has the lowest spec. heat

$$10,700\text{J} = (550.\text{g}) \Delta T (.14 \text{ J/g}^\circ\text{C})$$

$$\Delta T = 140^\circ\text{C}$$

43) $133 = 5.00 (29.9) c$
 $c = 0.890 \text{ J/g}^\circ\text{C} \text{ (aluminum)}$

44) $585 \text{ J} = 125.5\text{g} (33.5^\circ\text{C}) c$

$$c = \frac{0.139 \text{ J} \quad | \quad 200.59 \text{ g Hg}}{1 \text{ g }^\circ\text{C} \quad | \quad 1 \text{ mol Hg}} = 27.9 \text{ J/mol}^\circ\text{C Hg}$$

51) $q = m \Delta T c$
 $q = 100.0\text{g} (0.80^\circ\text{C}) 4.18\text{J/g}^\circ\text{C} \qquad \qquad q = 330 \text{ J}$

$$\frac{0.0500 \text{ L} \quad | \quad 0.100 \text{ mol AgNO}_3 \quad | \quad 1 \text{ mol AgCl}}{1 \text{ L} \quad | \quad 1 \text{ mol AgNO}_3} = 0.0050 \text{ mol AgCl}$$

$$\frac{330 \text{ J} \quad | \quad 1 \text{ kJ}}{0.0050 \text{ mol AgCl} \quad | \quad 1000 \text{ J}} = -66 \text{ kJ/mol or } 66 \text{ kJ/mol released}$$

52) $q = m \Delta T c$
 $q = 76.6 \text{ g } (-1.66^\circ\text{C}) 4.18 \text{ J/g}^\circ\text{C}$ $q = 532 \text{ J}$ absorbed from surroundings

$$\frac{532 \text{ J}}{1.60 \text{ g NH}_4\text{NO}_3} \times \frac{80.05 \text{ g NH}_4\text{NO}_3}{1 \text{ mol NH}_4\text{NO}_3} \times \frac{1 \text{ kJ}}{1000 \text{ J}} = \mathbf{26.6 \text{ kJ/mol NH}_4\text{NO}_3 \text{ dissolved}}$$

54) 2 moles of HCl are reacted for every 1 mole of $\text{Ba}(\text{OH})_2$.
 Since the amount of HCl used is less than double the amount of $\text{Ba}(\text{OH})_2$, HCl is the limiting reactant.

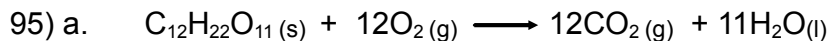
$$\frac{0.100 \text{ L}}{1 \text{ L}} \times \frac{0.500 \text{ mol HCl}}{2 \text{ mol HCl}} \times \frac{-118 \text{ kJ}}{2 \text{ mol HCl}} = 2.95 \text{ kJ released}$$

$q = m \Delta T c$
 $2,950 \text{ J} = 400.0 \text{ g } (\Delta T) 4.18 \text{ J/g}^\circ\text{C}$ $\Delta T = 1.76^\circ\text{C}$
 Final temp = 26.8°C



Both reactants react in a 1:1 ratio. Since there is less NaOH available, it is the limiting reactant.

$$\frac{0.150 \text{ L}}{1 \text{ L}} \times \frac{0.500 \text{ mol NaOH}}{1 \text{ mol HCl}} \times \frac{-56 \text{ kJ}}{1 \text{ mol HCl}} = 4.2 \text{ kJ released}$$



b. $\frac{-24.00 \text{ kJ}}{1.46 \text{ g sugar}} \times \frac{342.30 \text{ g sugar}}{1 \text{ mol sugar}} = -5630 \text{ kJ/mol}$

c. Same (-5630 kJ/mol)